

Firenze, 12 Novembre 2019

Workshop finale progetto FREEFORES

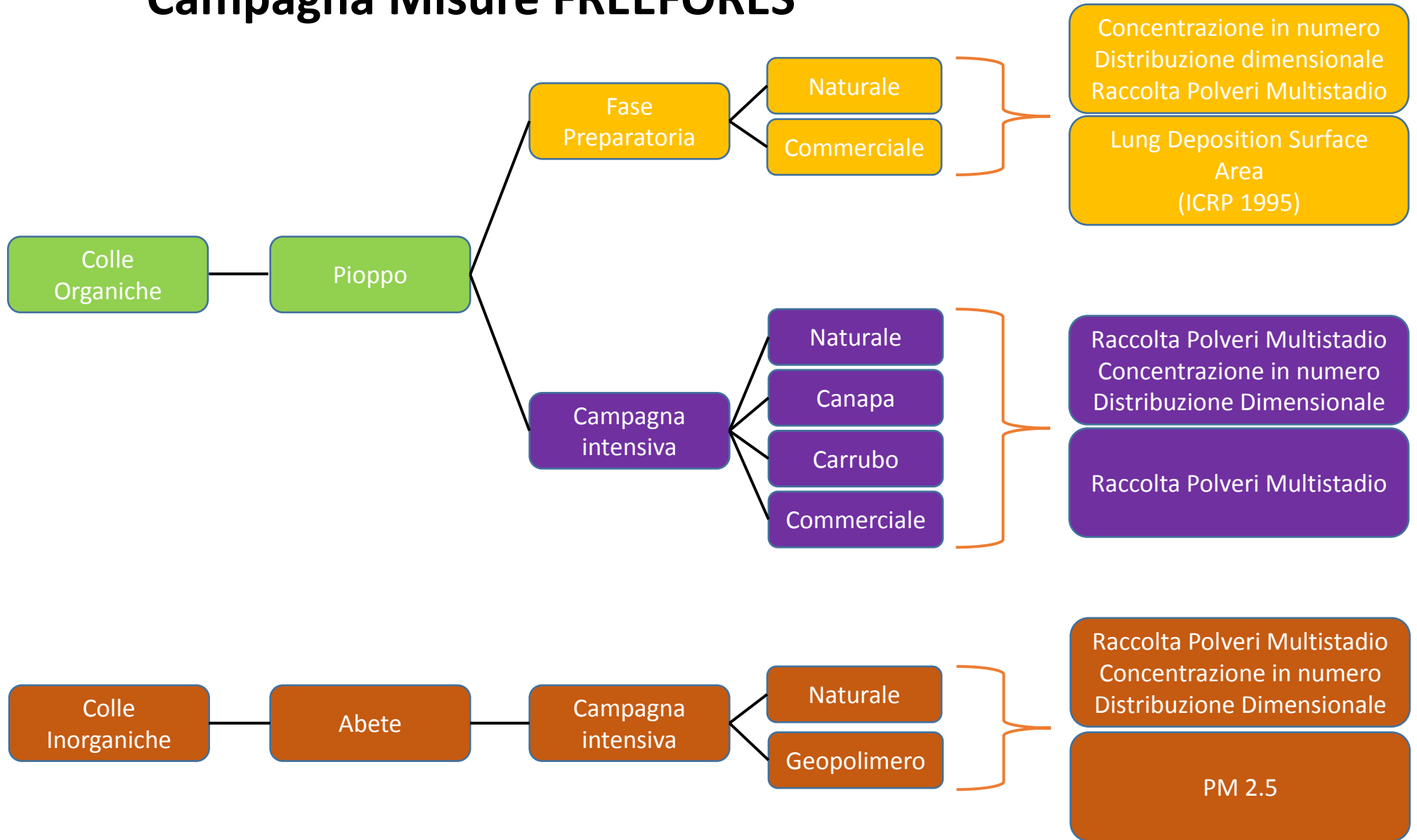
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CONTRO GLI INFORTUNI SUL LAVORO






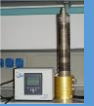

**«Caratterizzazione dimensionale e morfologica di
polveri ultrafini generate da attività di segagione in
ambiente controllato: risultati preliminari»**

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Campagna Misure FREEFORES



	Instrument	Class	Principle of operation	Output	Size range (nm)	Time resolution (s)	Flux (L/min)	Detection limits	Accuracy
	CPC TSI Inc. Mod. 3007	Real-time	Optical detection	PNC (part./cm ³)	10 – 1,000	1	0.7	1 – 100,000 part./cm ³	±20%
	FMPS TSI Inc. Mod. 3091	Real-time	Electrical mobility	PNC (part./cm ³) Size distribution	5,6 - 560	1	10	Small part.: 100-1x10 ⁷ part./cm ³ Large part.: 1-1x10 ⁵ part./cm ³	±15% MDC*
	NSAM TSI Inc. Mod. 3550	Real-time	Diffusion charging	Surface area running avg (µm ² /cm ³) and total (µm ²) TB or A fractions	10 – 1,000	1	2.5	TB: 0 - 2,500 µm ² /cm ³ A: 0 – 10,000 µm ² /cm ³	±20%
	HR-ELPI+	Real-time/Integration time	Diffusion charging/Aerodynamic diameter	PNC (part./cm ³) Size distribution Particle gravimetric mass Samples for off-line analysis	6 -10,000	1	10	-250 part./cm ³ for 10 nm particles, 20 part./cm ³ for 100 nm particles, 1.0 part./cm ³ for 1 µm particles, 0.1 part./cm ³ for 5 µm particles	-
	DISCmini TESTO	Real-time	Diffusion charging	Number concentration (#/cm ³) Avg. particle diameter (nm) Lung deposited surface area	10 - 700	1	1	20nm: 2x10 ³ – 1x10 ⁶ part./cm ³ 100nm: 5x10 ² – 5x10 ⁵ part./cm ³	±30%
	nanoMOUDI MSP Mod. 122 R	Time-integrated Area sampler	Aerodynamic diameter	Particle gravimetric mass Size distribution Samples for off-line analysis	10 – 18,000	-	30	-	-
	SILENT PM 2.5	Time-integrated Area sampler	Aerodynamic diameter	Particle gravimetric mass Size collection Samples for off-line analysis	<2,500	-	10	-	-

*Mean Diameter Counting (MCD) vs SMPS TSI/3936 for particles <100nm of polystyrene latex (PSL). Source: Asbach et al., J Nanopart Res (2009) 11:1593–1609

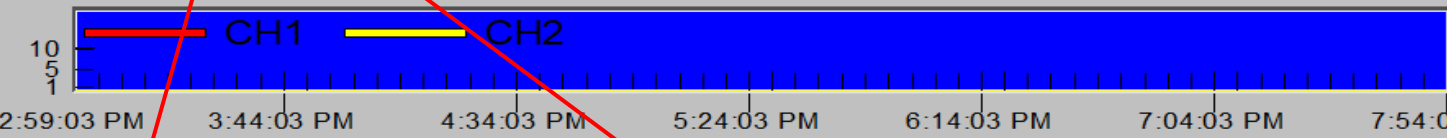
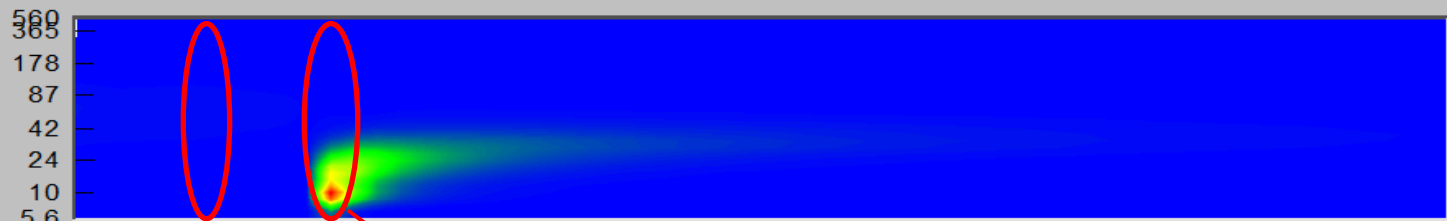
Fase Preparatoria

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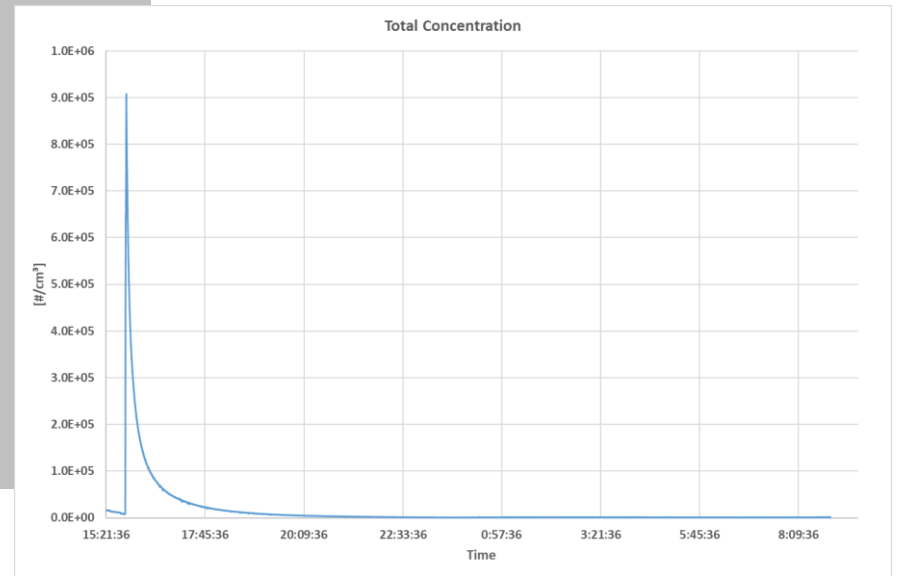
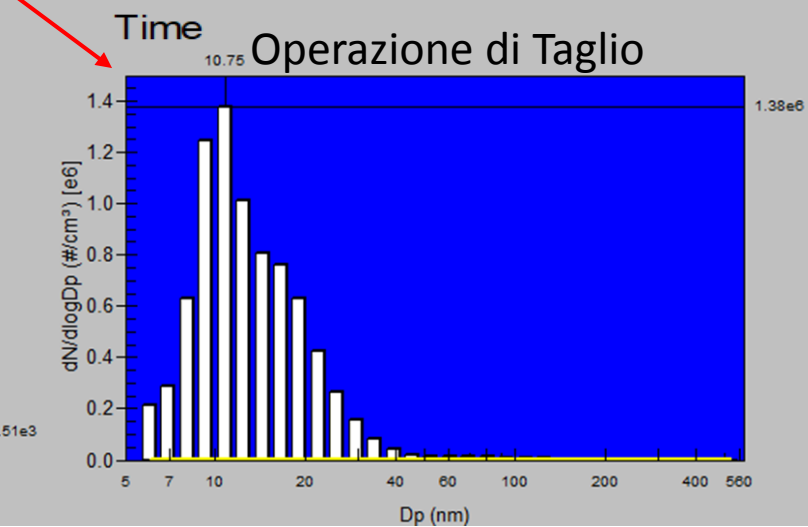
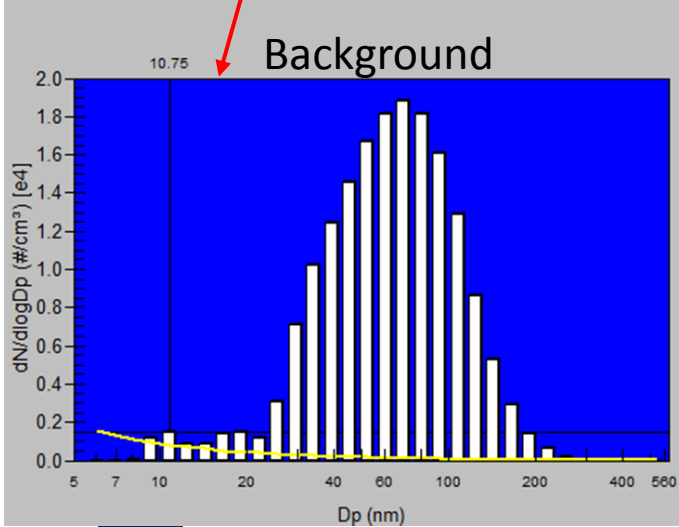
$dN/d\log D_p$ ($\#/cm^3$)

0 1.5e5 3e5 4.5e5 6e5 7.5e5 9e5 1.1e6 1.2e6 1.4e6 1.53e6

Particle Size (nm)



Durata taglio 1' e 50 sec
Monitoraggio 17 h

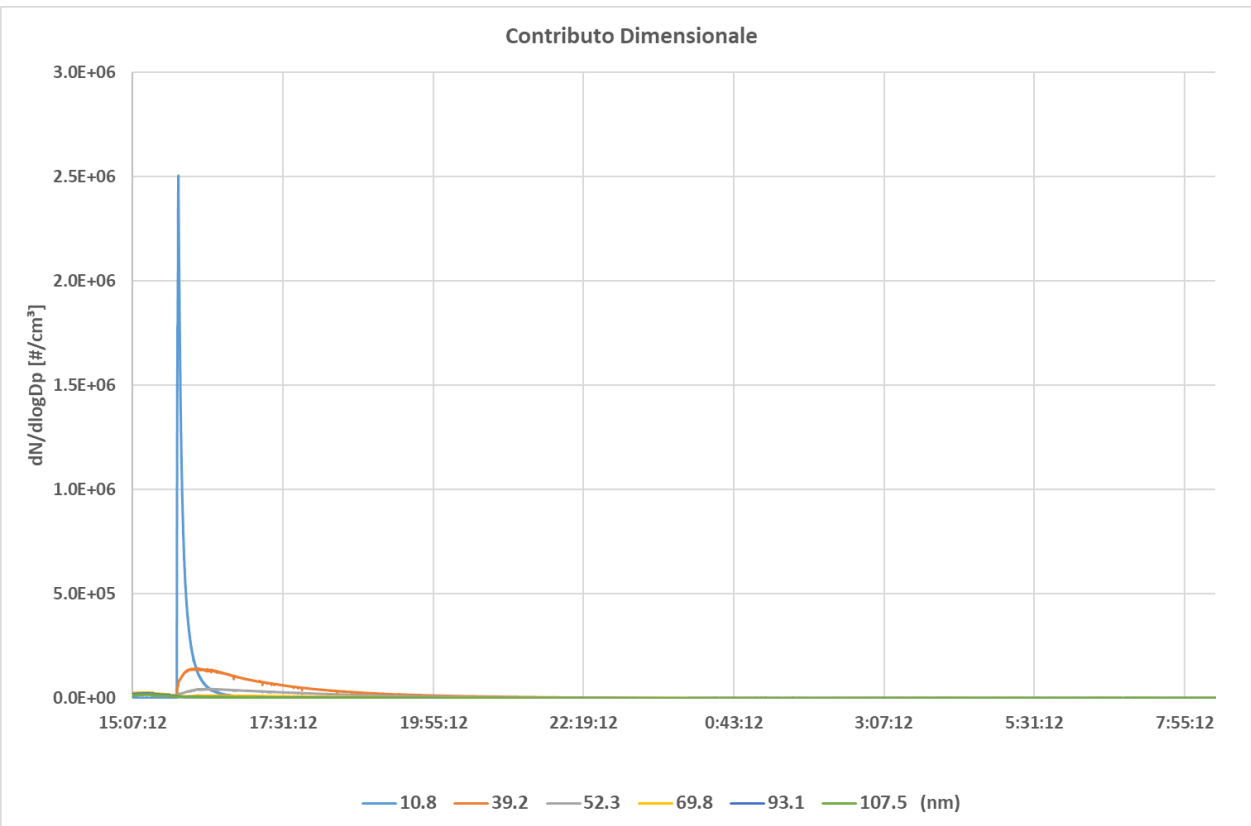


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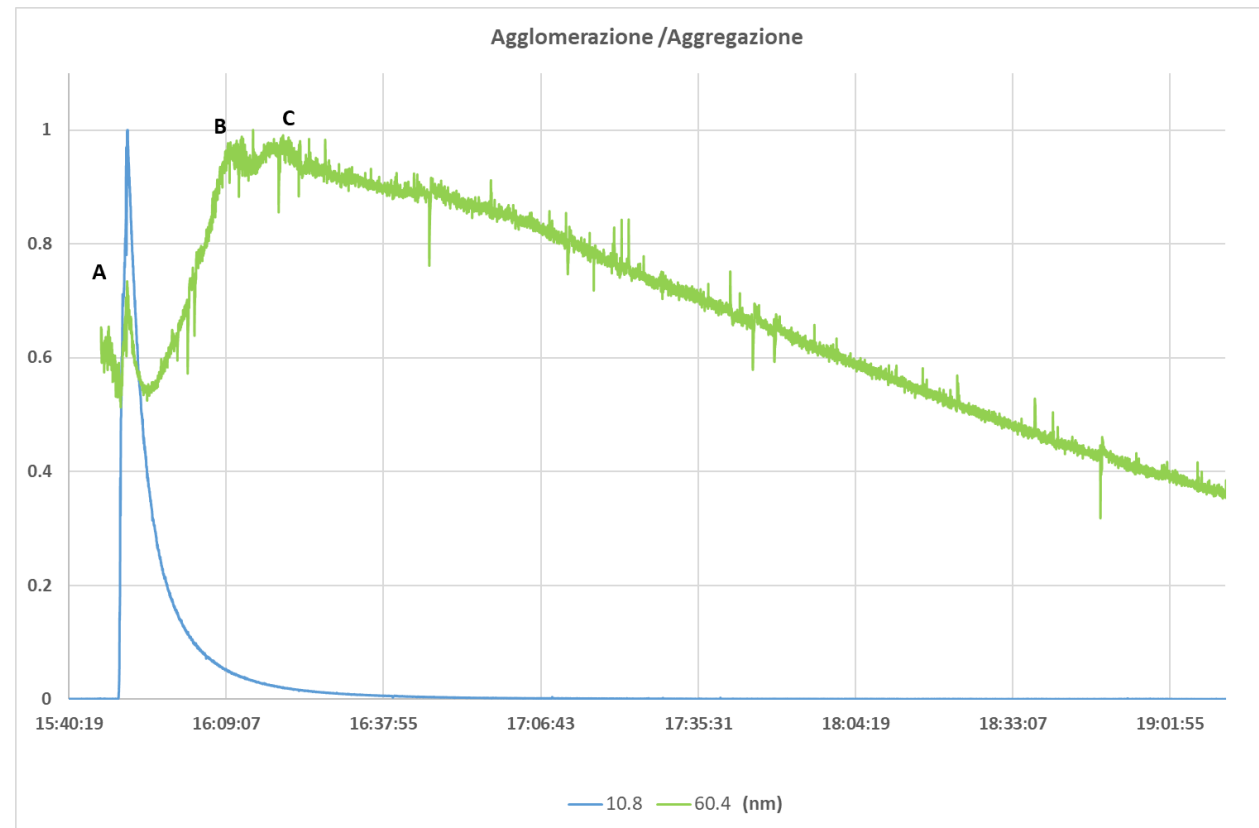
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Effetto di Aggregazione/Agglomerazione



- Esempio di 6 frazioni dimensionali come contributo alla concentrazione totale delle polveri prodotte.
- 10,8 nm frazione dimensionale predominante.

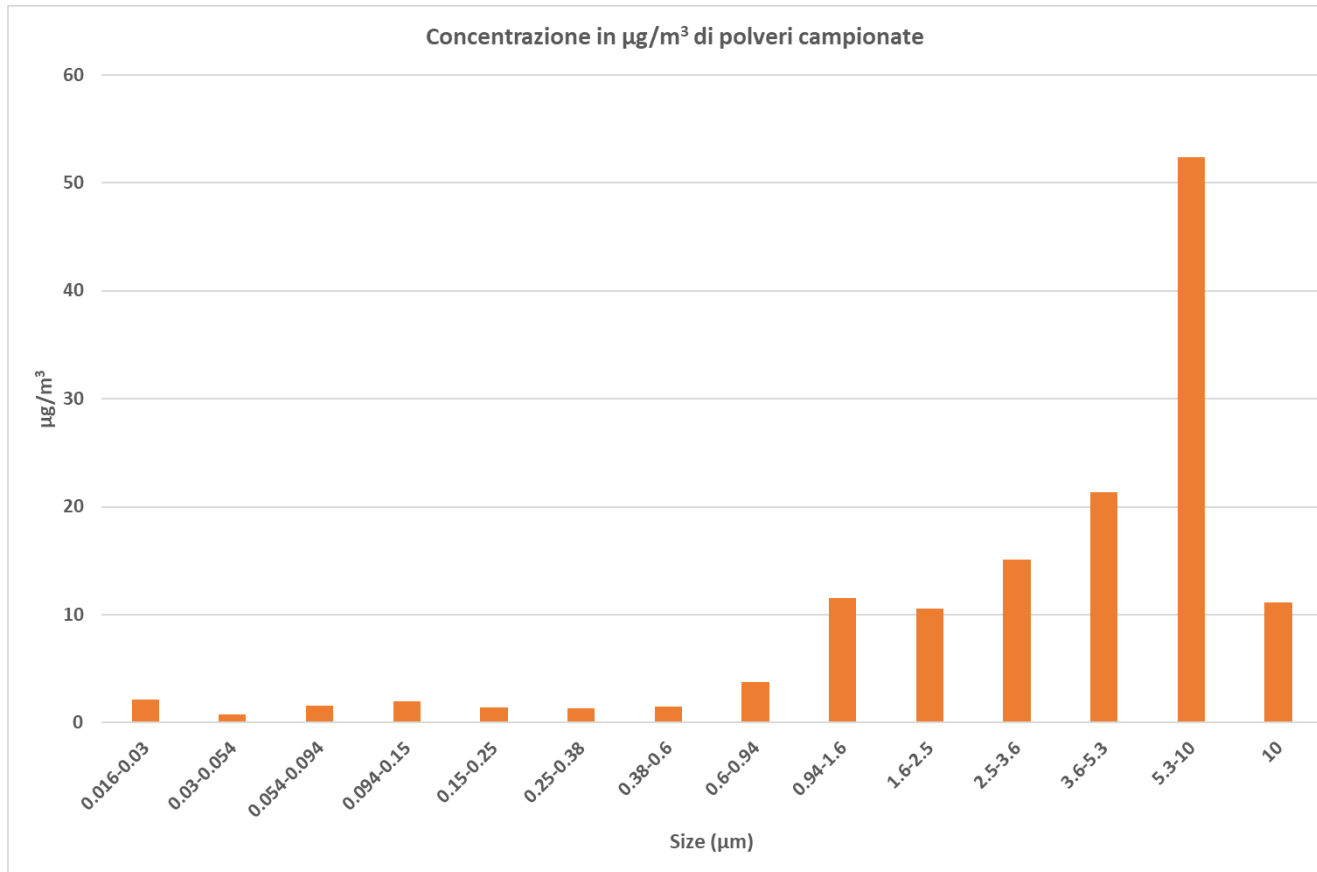
10.8 e 60.4 normalizzate ad 1 per il loro massimo valore
10.8 nm decremento regolare
60.4 nm: A) Incremento tempo 0
B) Incremento dopo 20 min dal taglio
C) Incremento dopo 30 min dal taglio



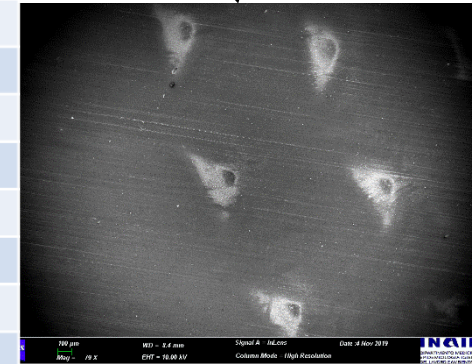
Analisi Gravimetriche

Polveri raccolte su filtri in Teflon per impatto inerziale

14 Stage: 0.016, 0.030, 0.054, 0.094, 0.15, 0.25, 0.38, 0.60, 0.94, 1.6, 2.5, 3.6, 5.3, 10 μm



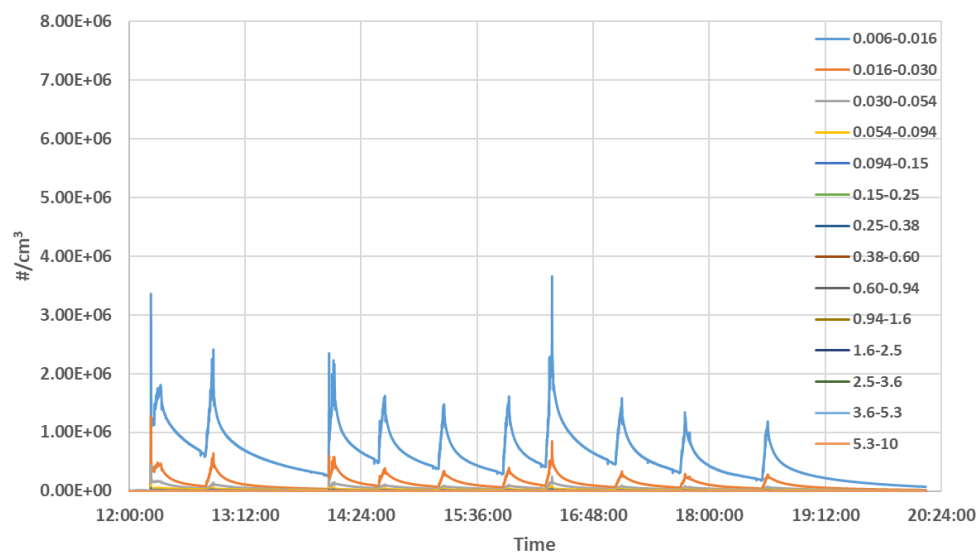
D50% (μm)	$\mu\text{g}/\text{m}^3$
0.016-0.03	2.234
0.03-0.054	0.780
0.054-0.094	1.667
0.094-0.15	2.057
0.15-0.25	1.489
0.25-0.38	1.383
0.38-0.6	1.560
0.6-0.94	3.936
0.94-1.6	12.057
1.6-2.5	11.028
2.5-3.6	15.709
3.6-5.3	22.234
5.3-10	54.610
10	11.631



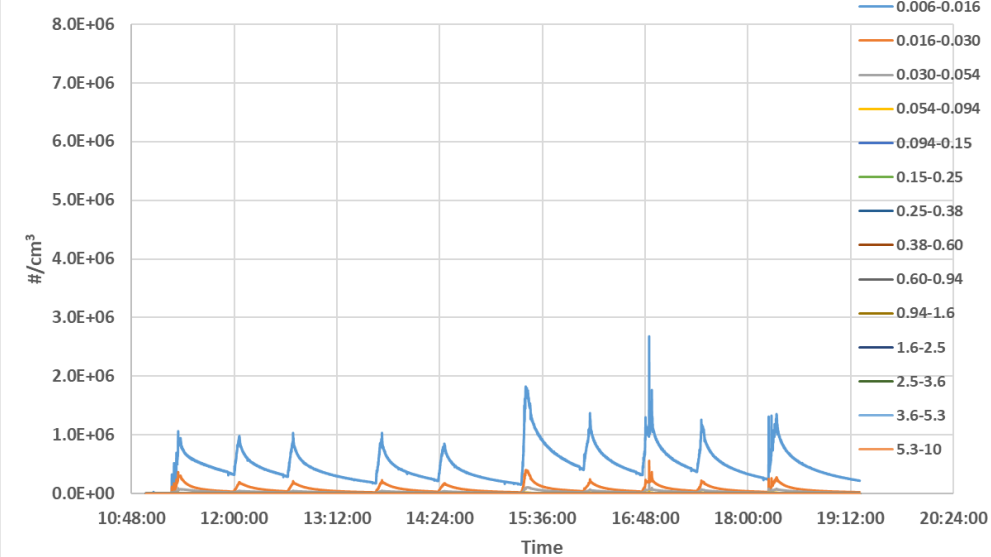


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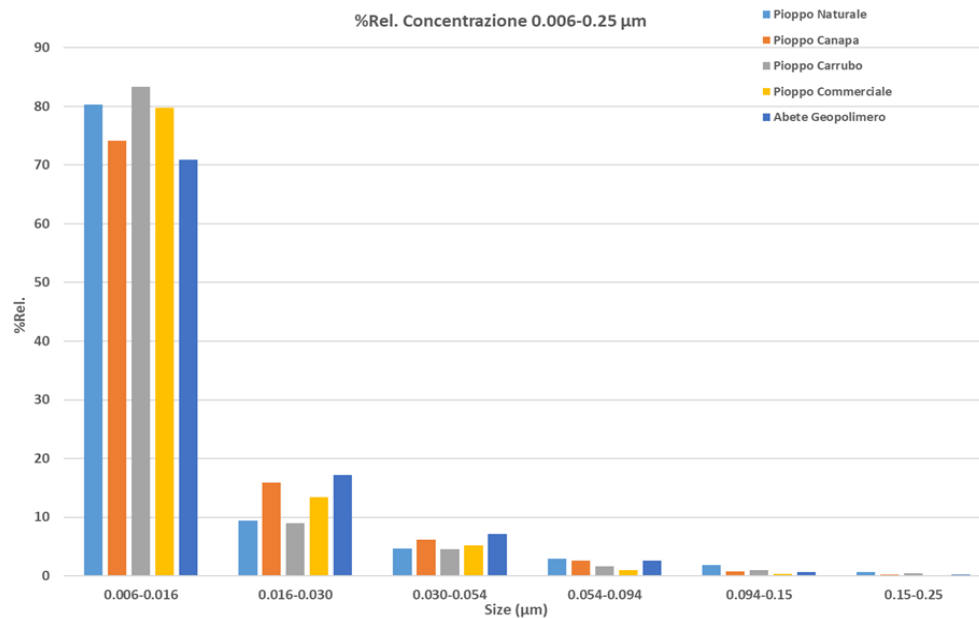
Pioppo Canapa



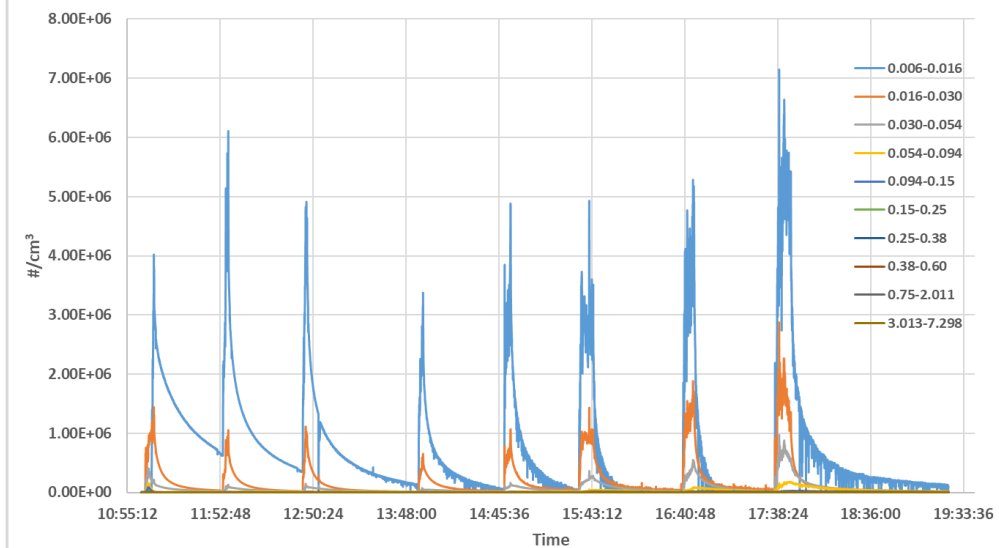
Pioppo Commerciale

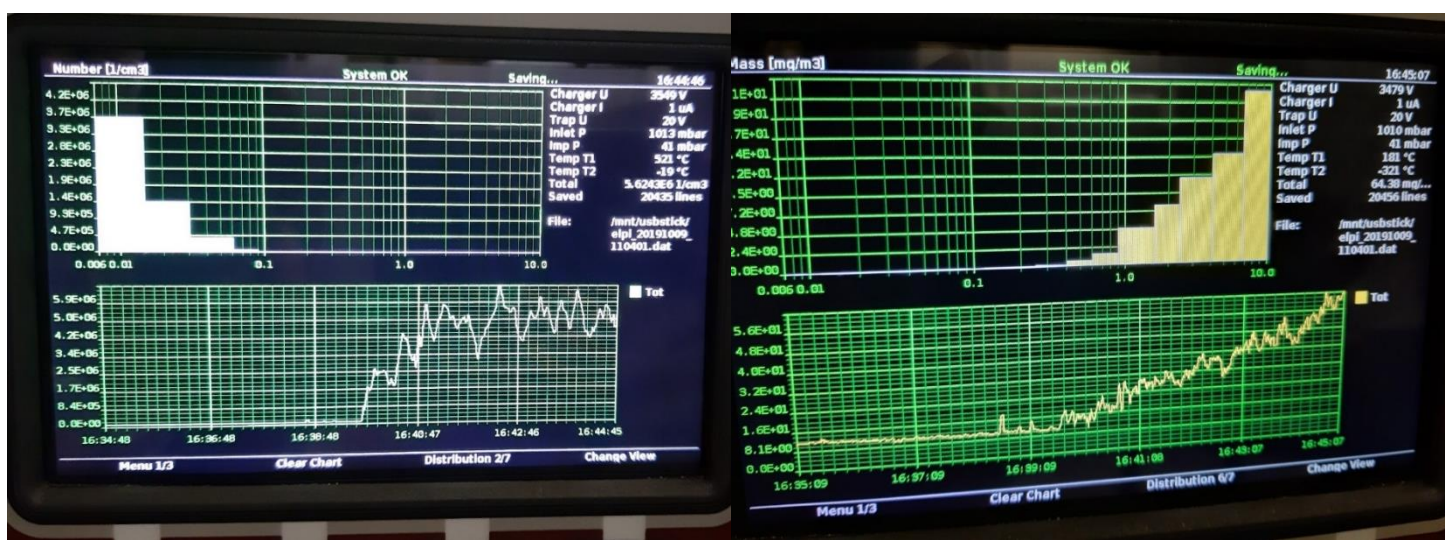


%Rel. Concentrazione 0.006-0.25 µm

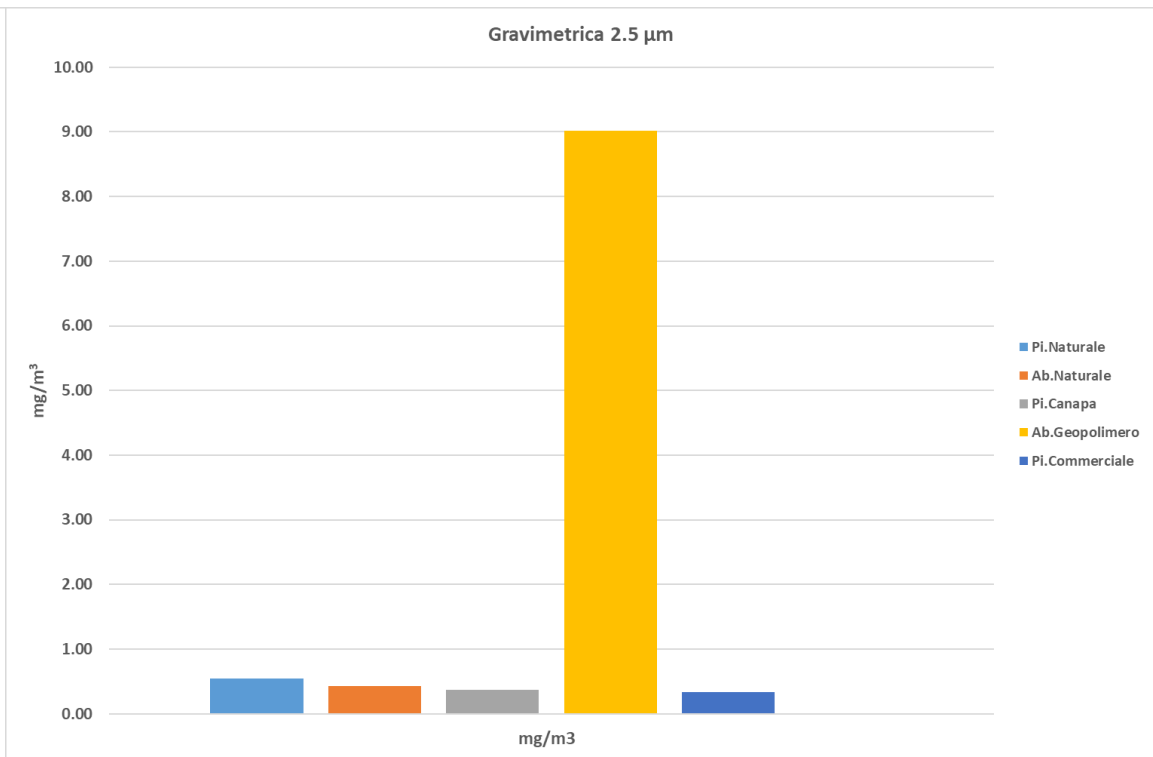
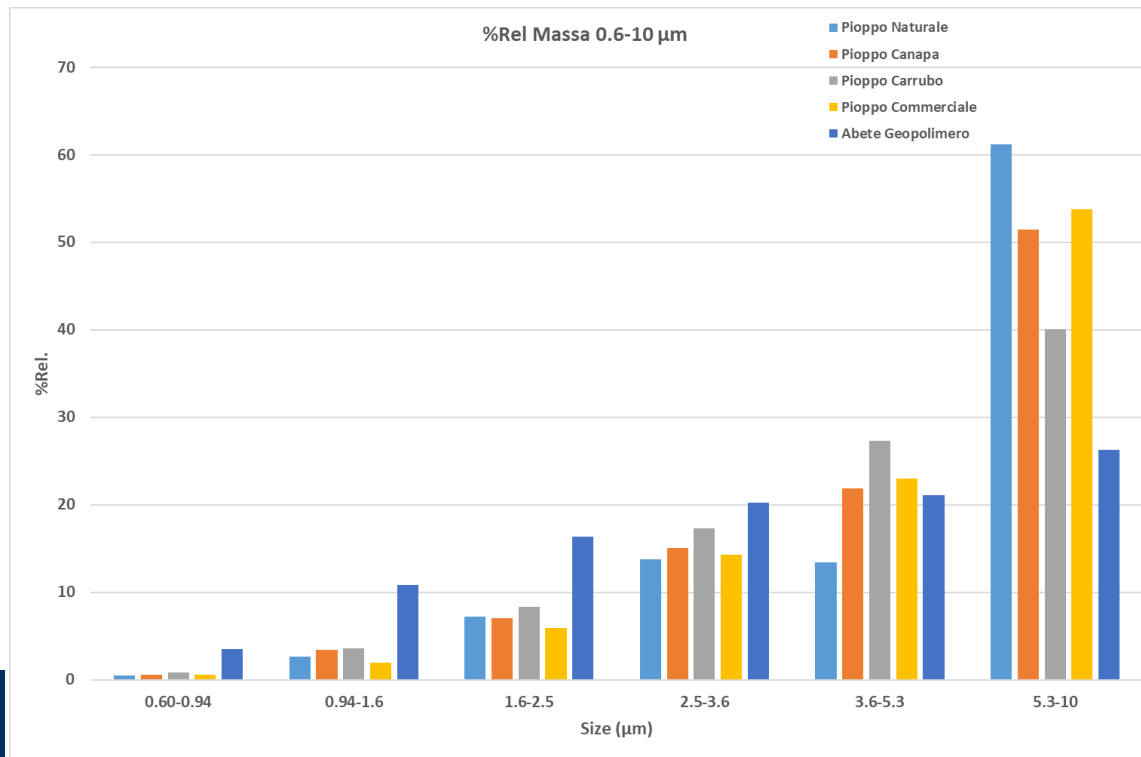


Abete Geopolimero

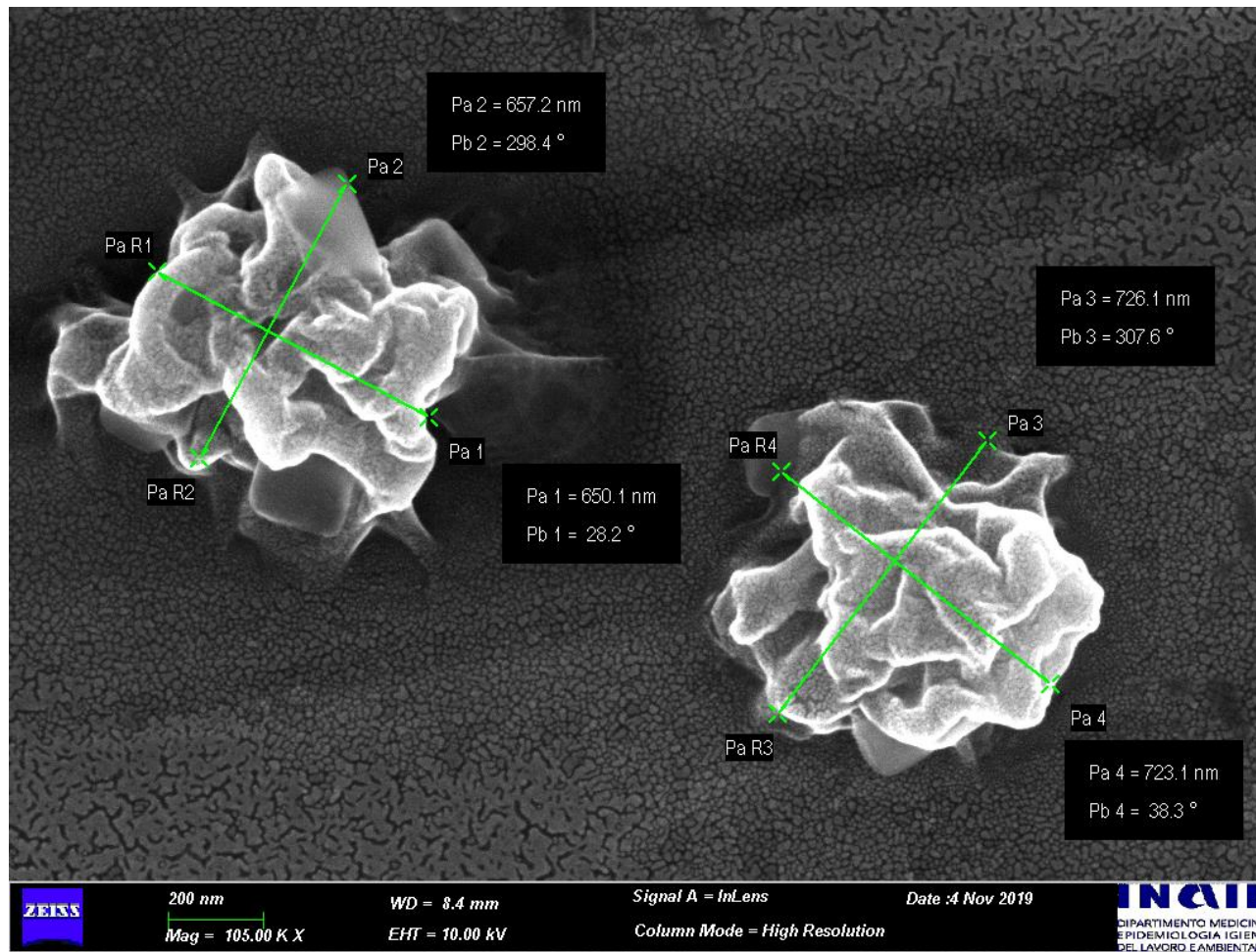
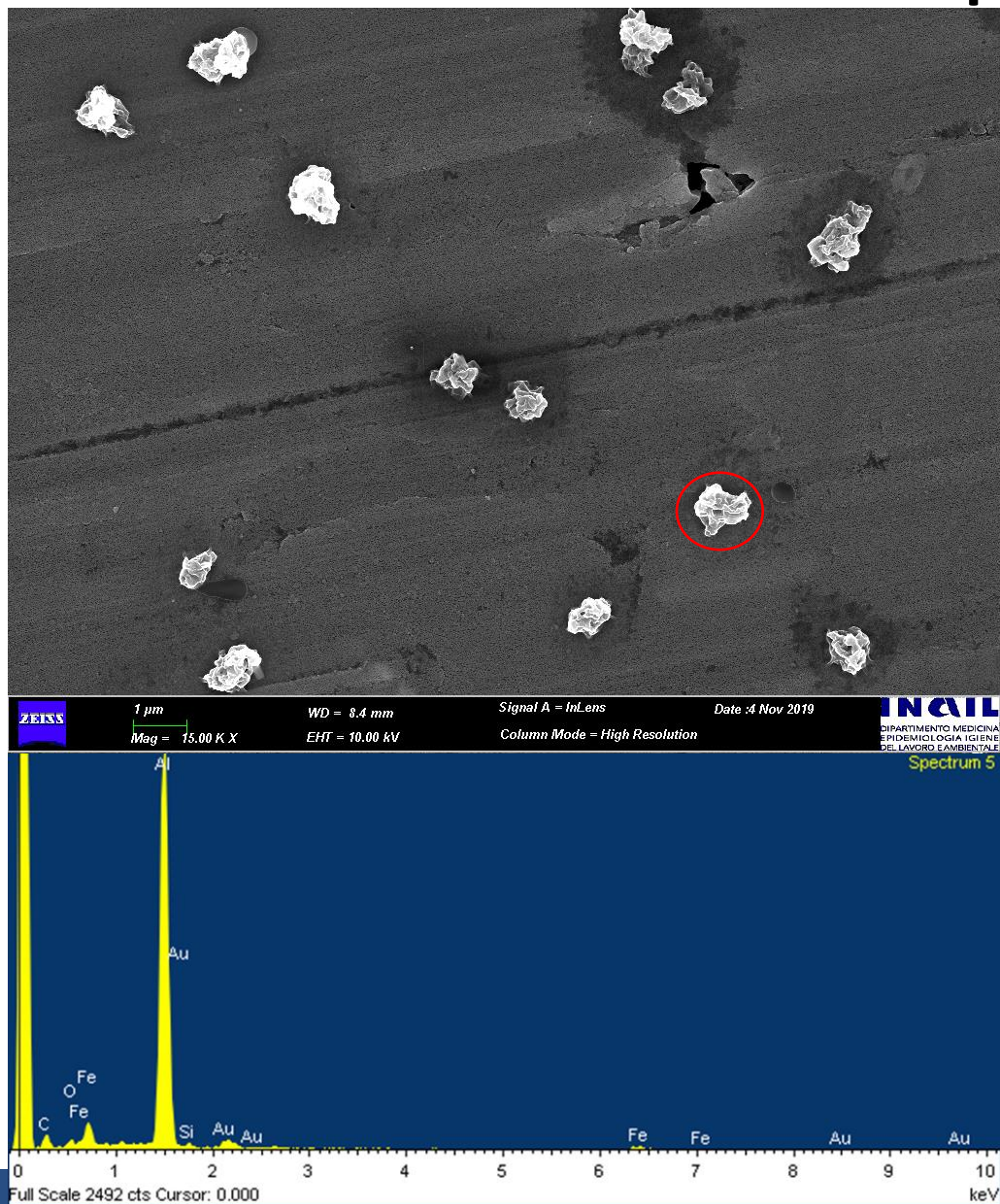




PM 2.5	
Tipo di legno	mg/m ³
Pi.Naturale	0.551
Ab.Naturale	0.429
Pi.Canapa	0.372
Ab.Geopolimero	9.018
Pi.Commerciale	0.332



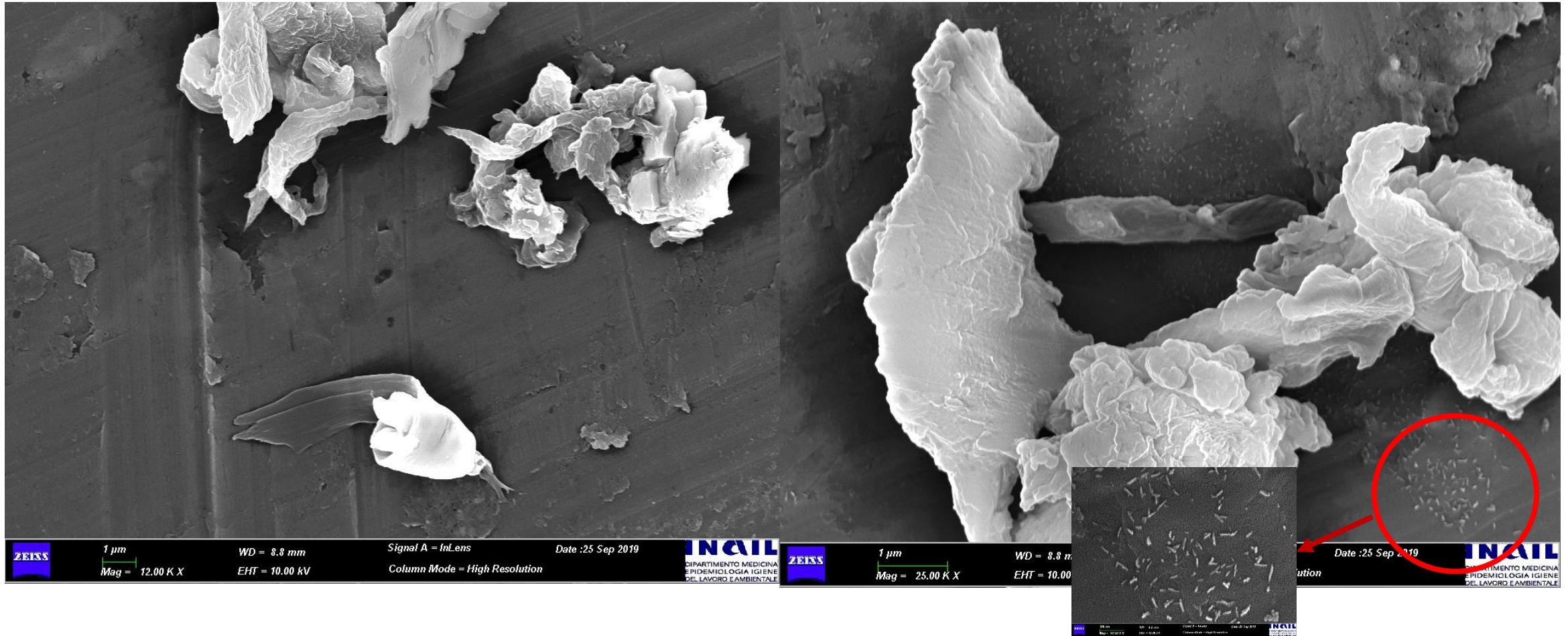
Pioppo Canapa Stage 10 (0.94-1.6 micron) 25 giugno canapa



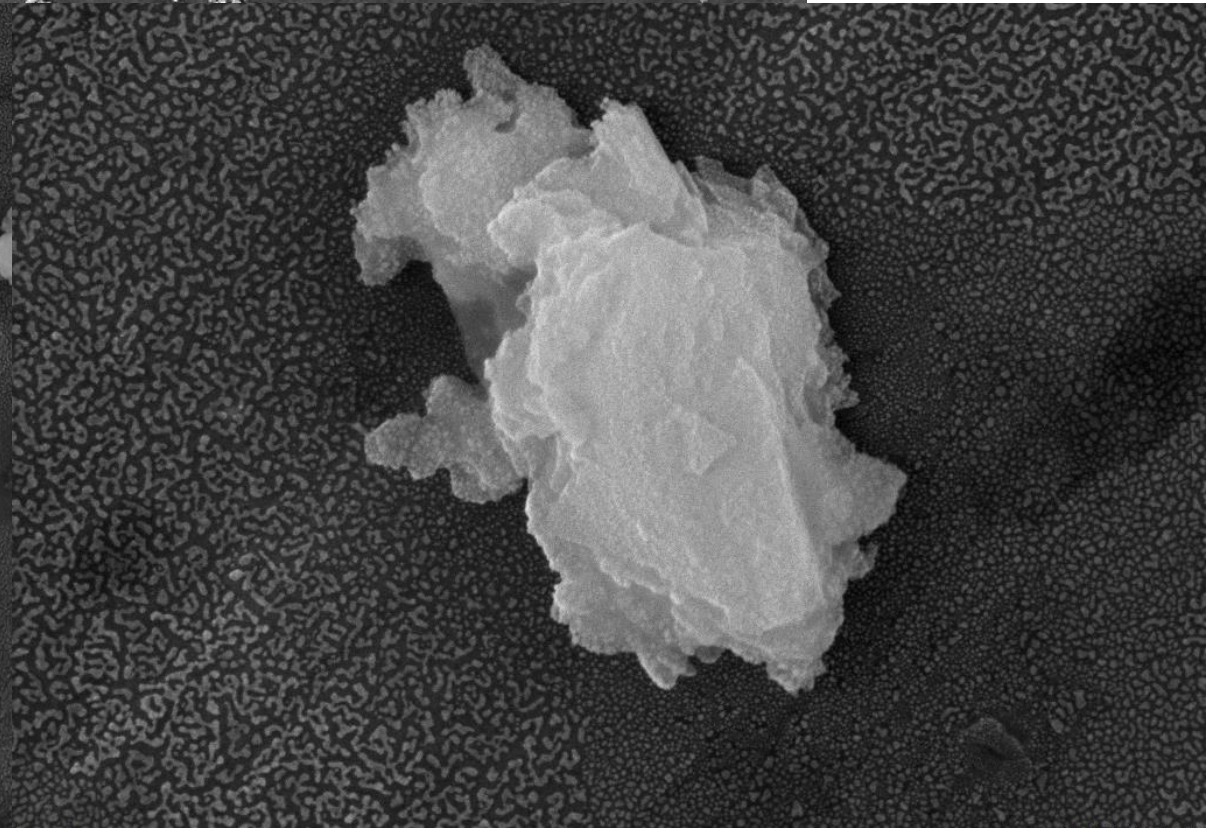
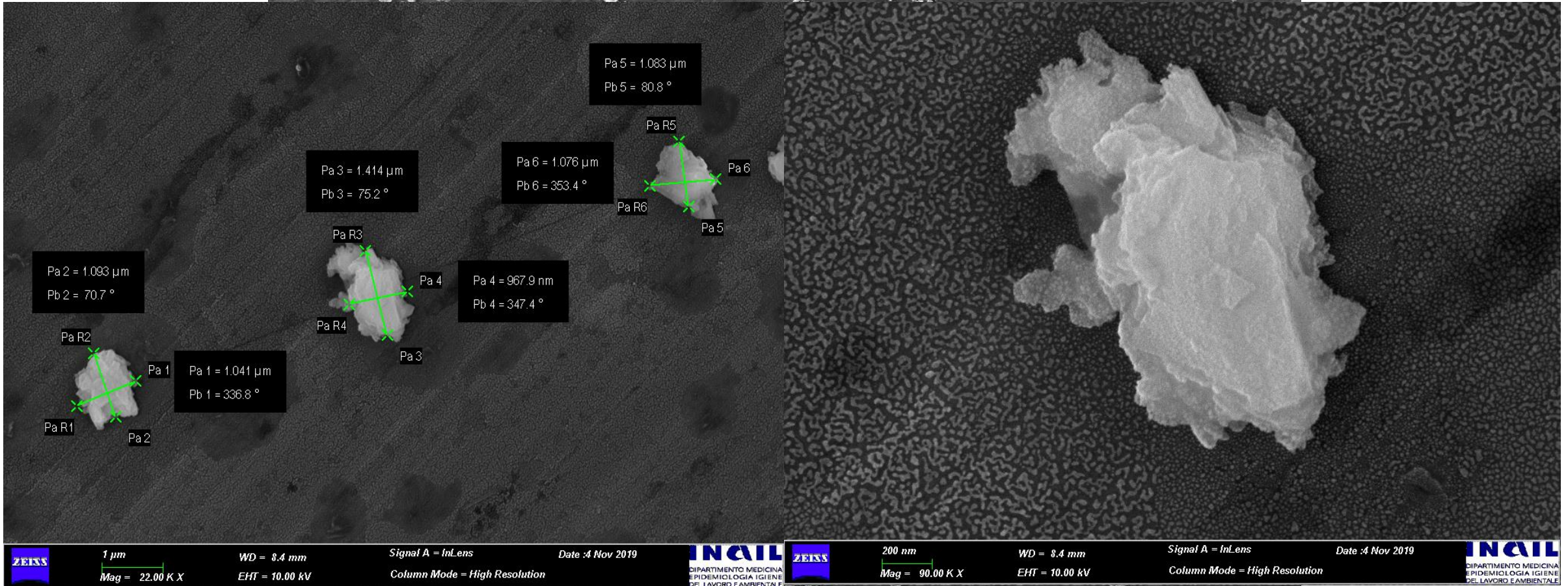
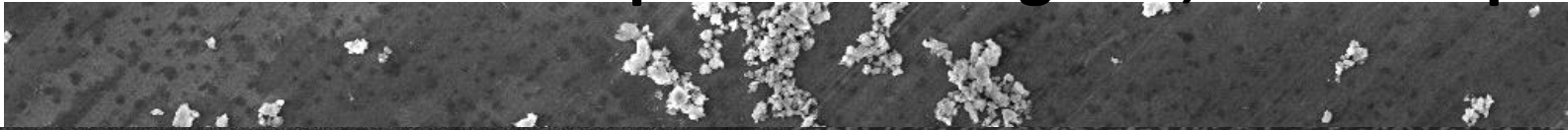
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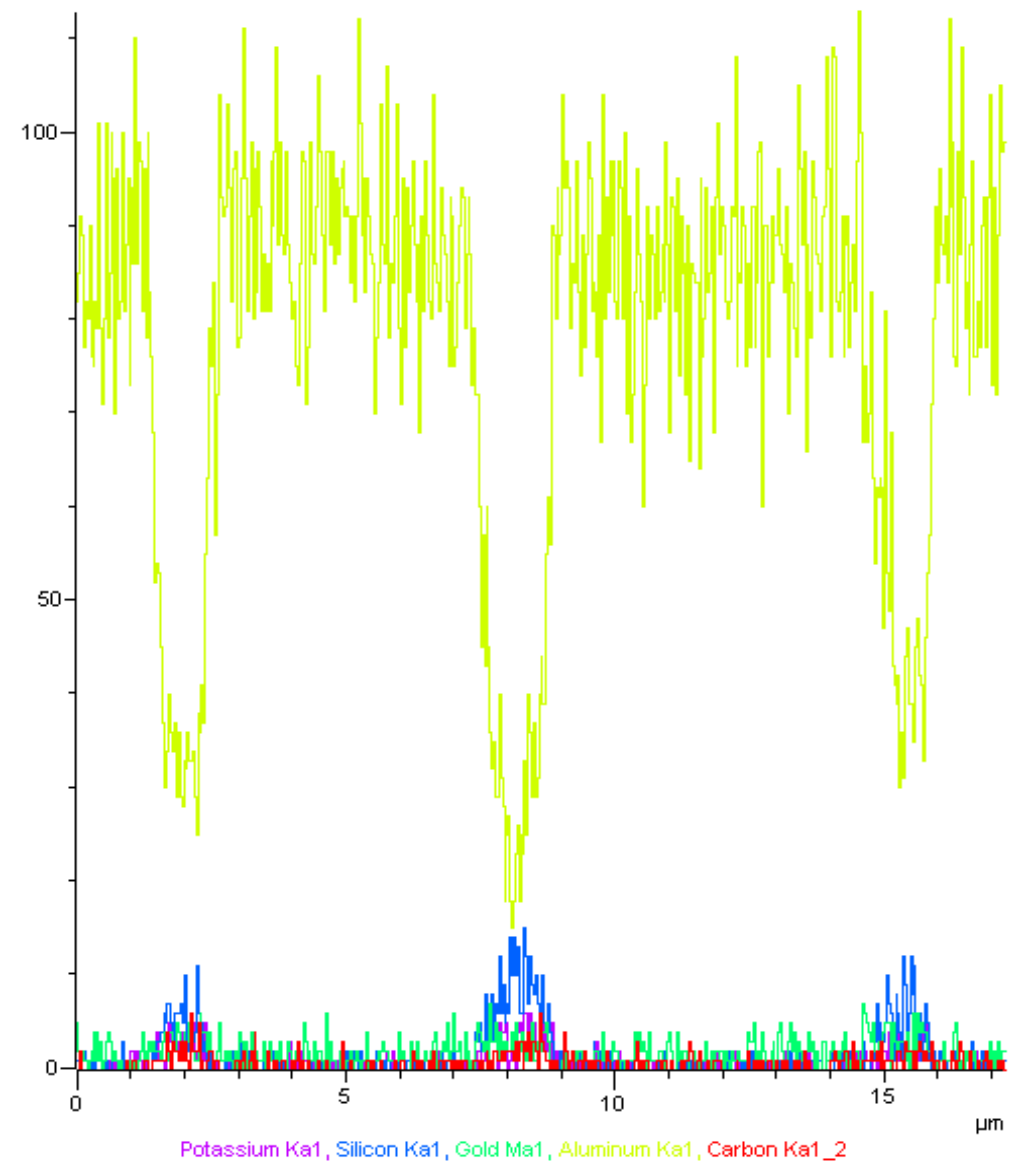
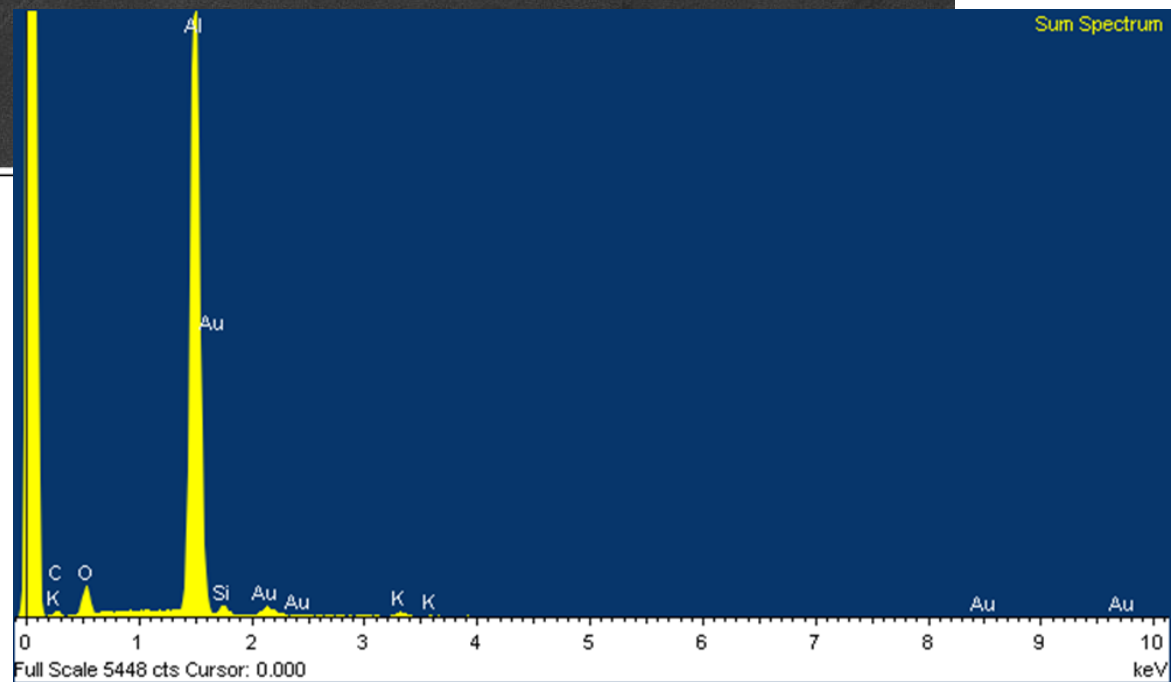
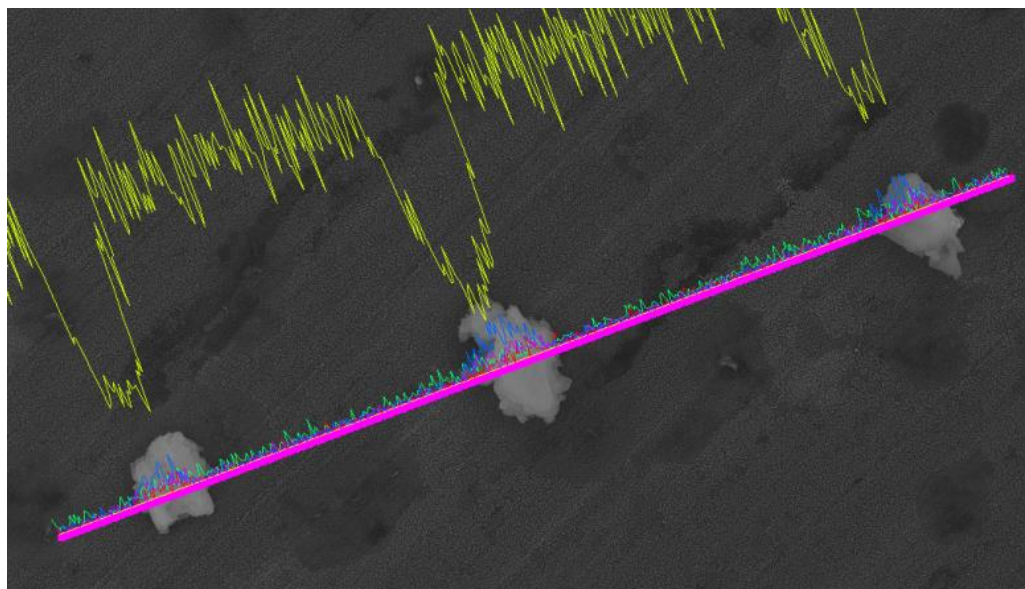
Stage 12 2.5-3.6 μm Pioppo Commerciale



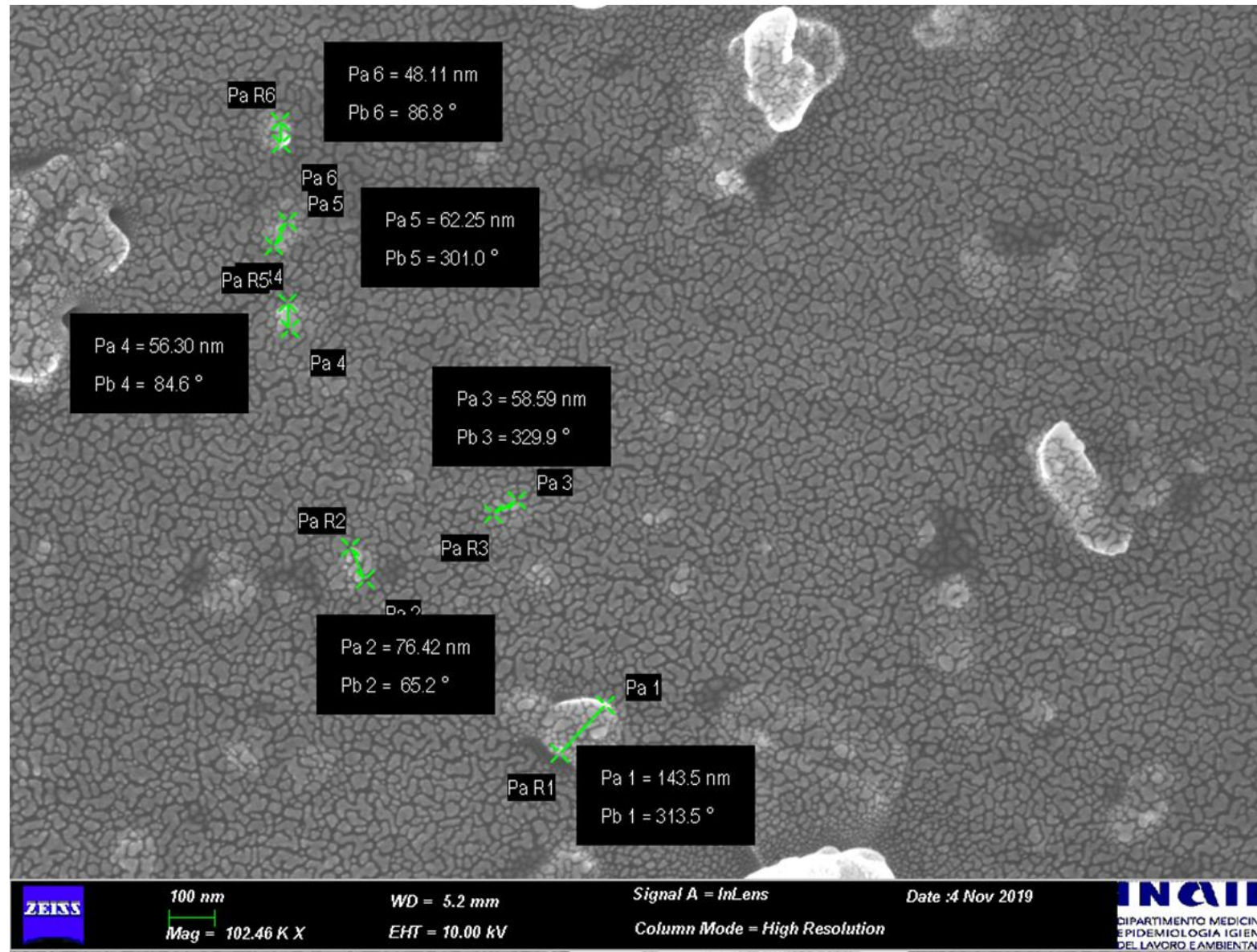
Abete Geopolimero Stage 10, 0.94-1.6 μm



Analisi EDS



Abete Geopolimero Stage 2, 16-30 nm



Grazie per l'attenzione!

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